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(54) **NON-INTEGRAL FAN BLADE PLATFORM**

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F01D 11/00 (2006.01)
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CPC ***F01D 5/3038*** (2013.01); ***F01D 5/3007*** (2013.01); ***F01D 11/008*** (2013.01); ***F02K 3/06*** (2013.01); ***F04D 29/321*** (2013.01); ***F04D 29/644*** (2013.01); *F05D 2220/36* (2013.01); *F05D 2260/30* (2013.01); *Y02T 50/672* (2013.01); *Y10T 29/4932* (2015.01)

(58) **Field of Classification Search**
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USPC .... 416/193 A
See application file for complete search history.

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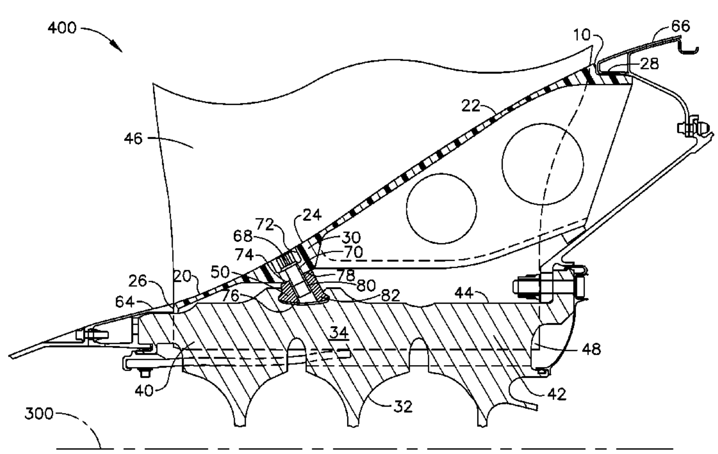
(57) **ABSTRACT**

Described are a gas turbine engine fan blade platform, related rotor assembly and gas turbine engine, as well as a method of assembling the same. The platform has a forward portion proximal to an axis of rotation, an aft portion, and a transition portion between the forward and aft portions. The forward portion has a forward interface surface facing axially forward, the aft portion has an aft interface surface facing radially outward, and the transition portion has at least one mounting feature. For the method of assembly, an aft support is installed on a fan disk and booster spool assembly. A plurality of fan blades are installed into a fan disk, followed by installing a fan platform between adjacent blades and securing the mounting features to the disk, thereby filling the annulus of the fan disk. Finally, a forward support is installed on the fan disk.

11 Claims, 10 Drawing Sheets



(51) **Int. Cl.**

F02K 3/06	(2006.01)
F04D 29/32	(2006.01)
F04D 29/64	(2006.01)

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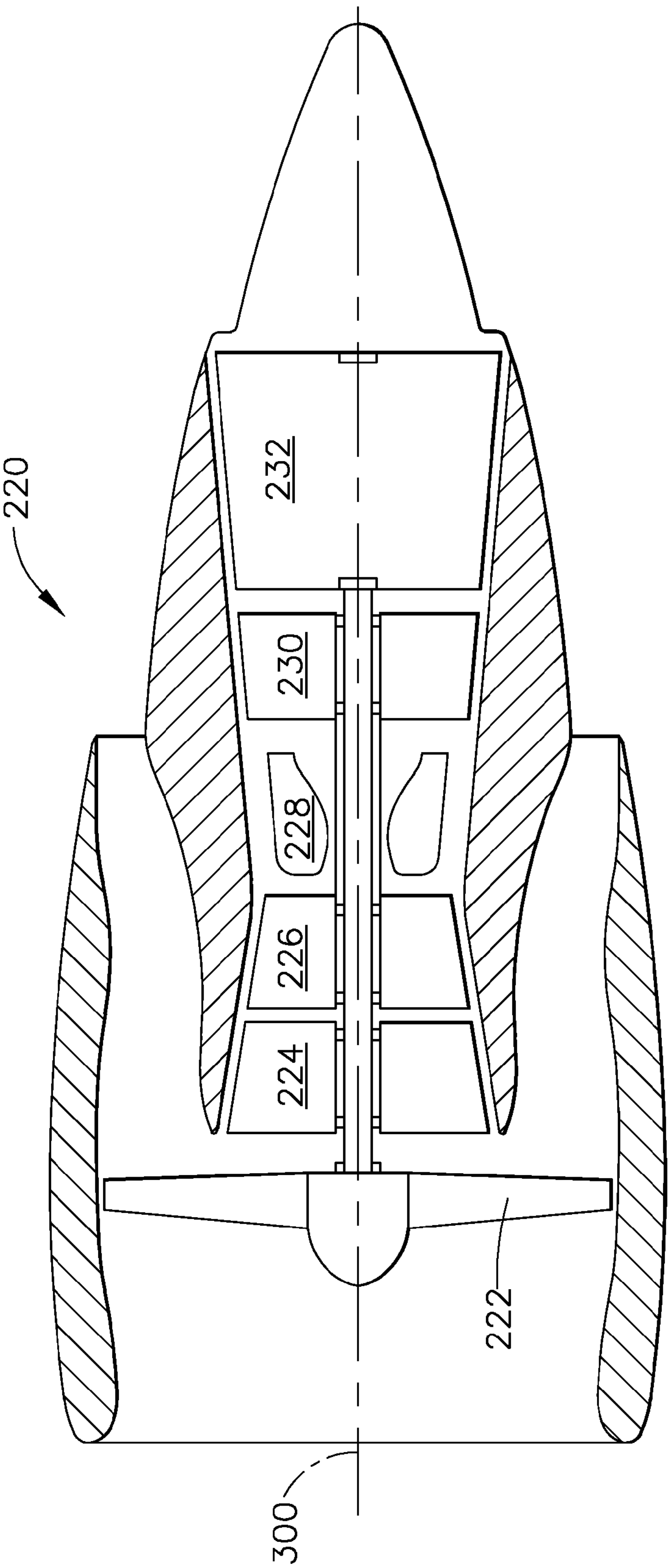
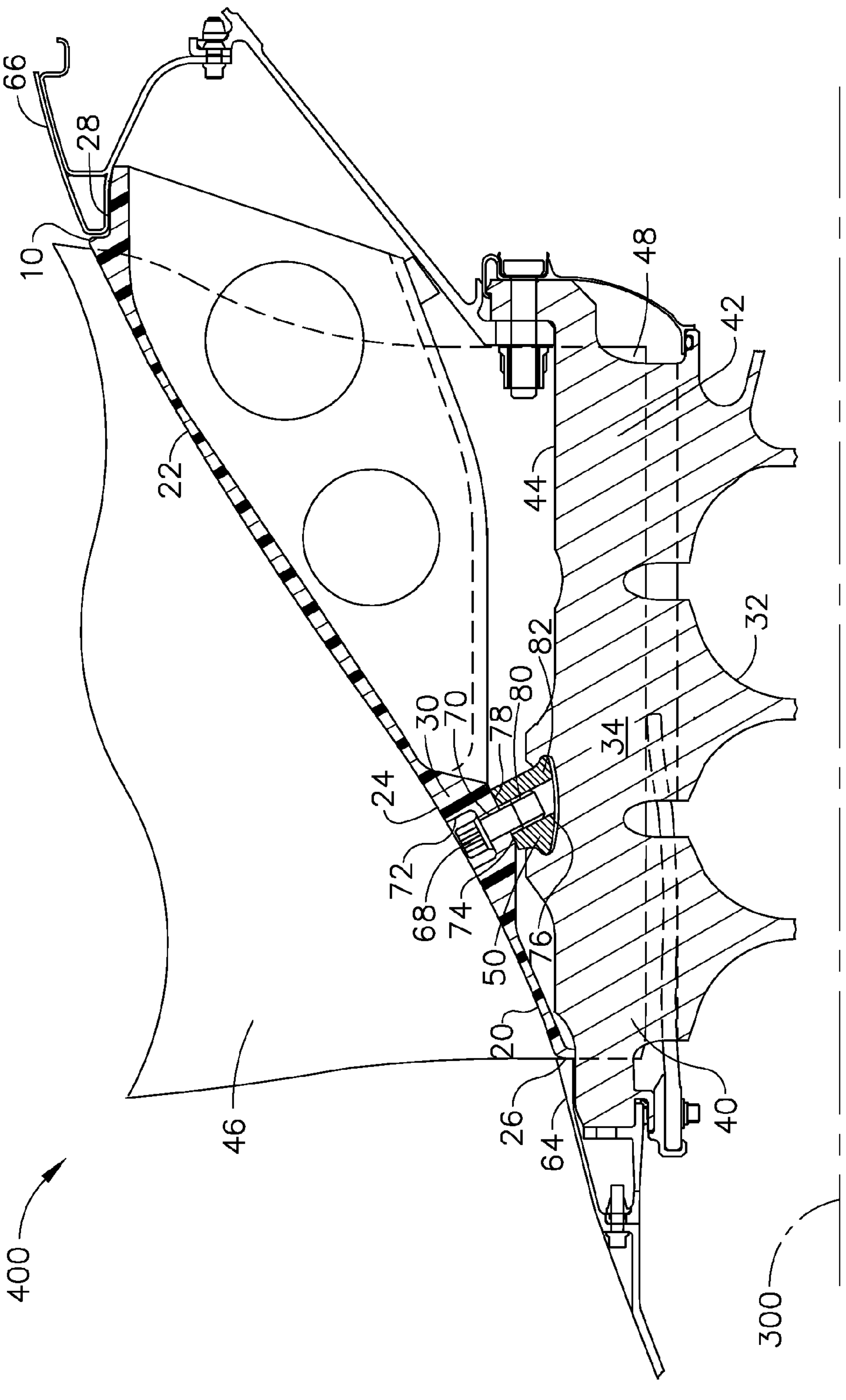


FIG. 1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26
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FIG. 2

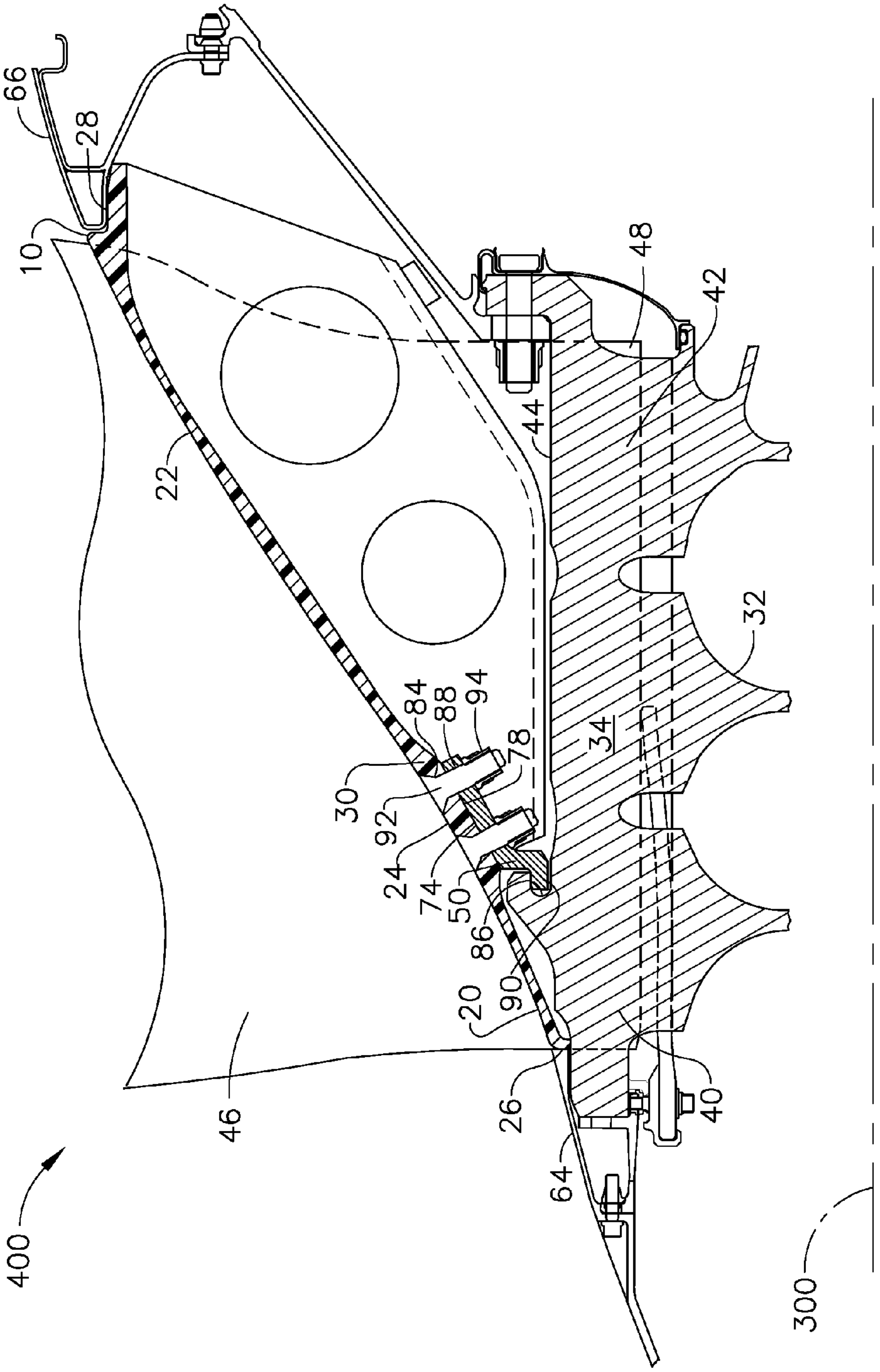
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FIG. 3

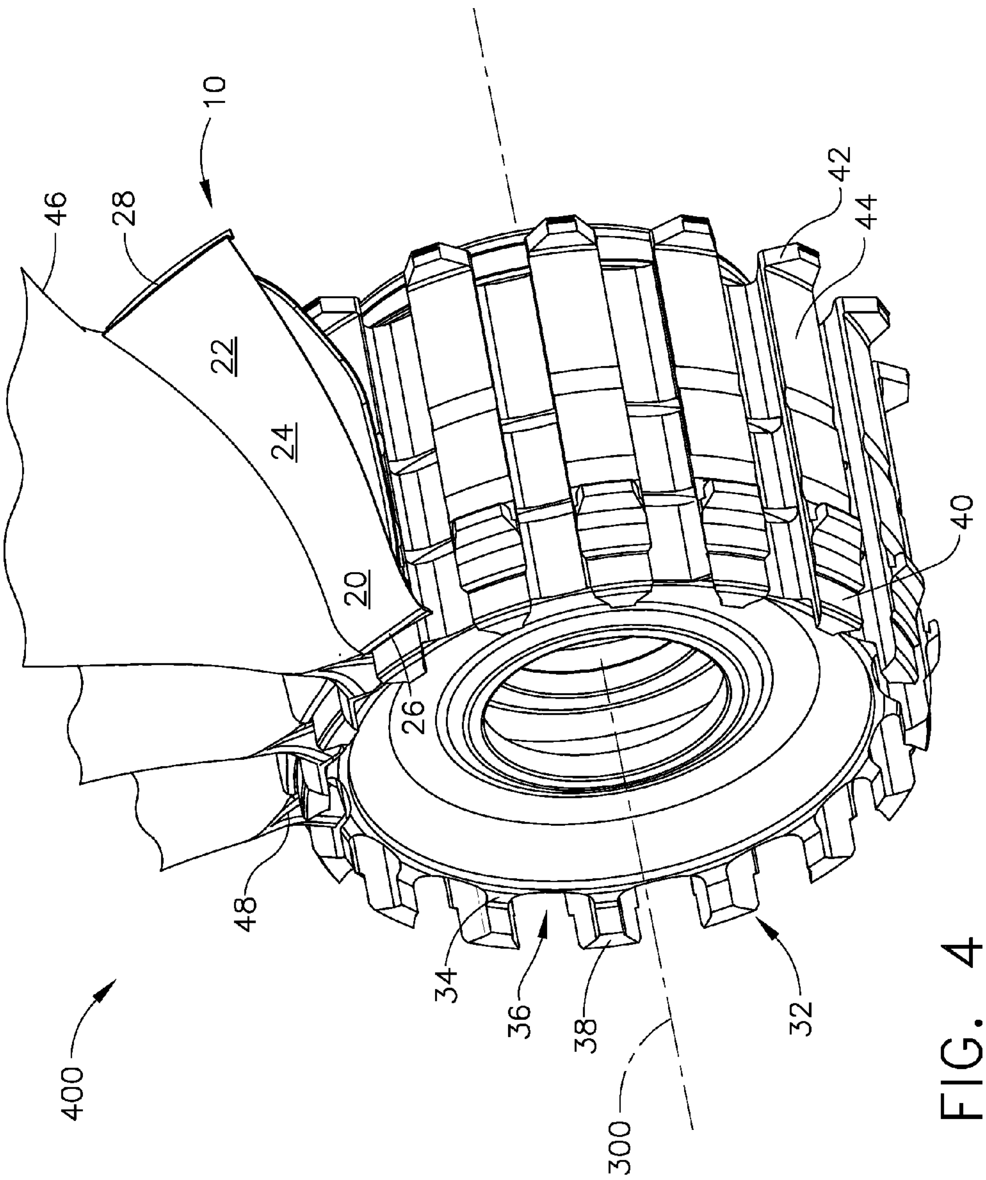
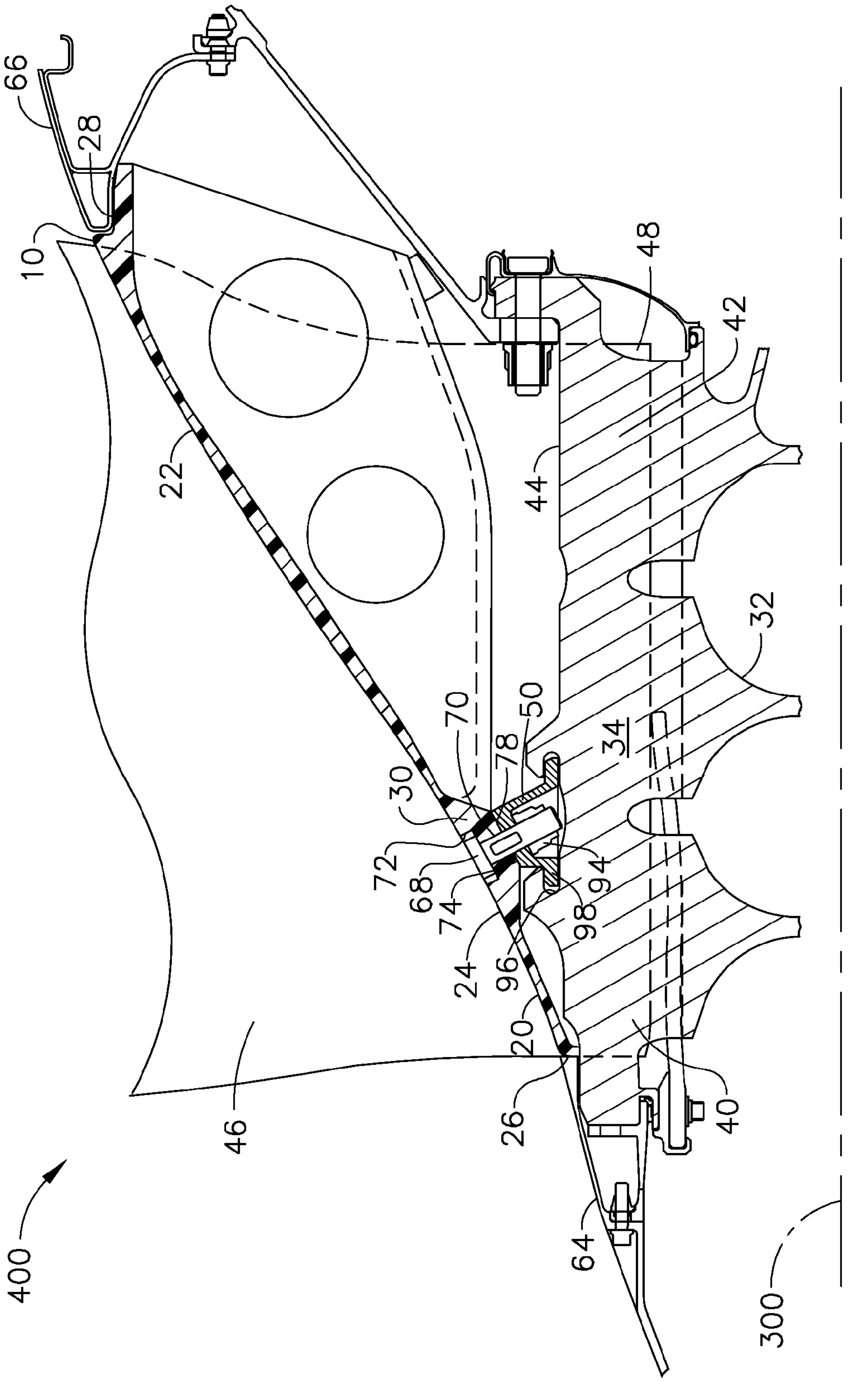


FIG. 4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74
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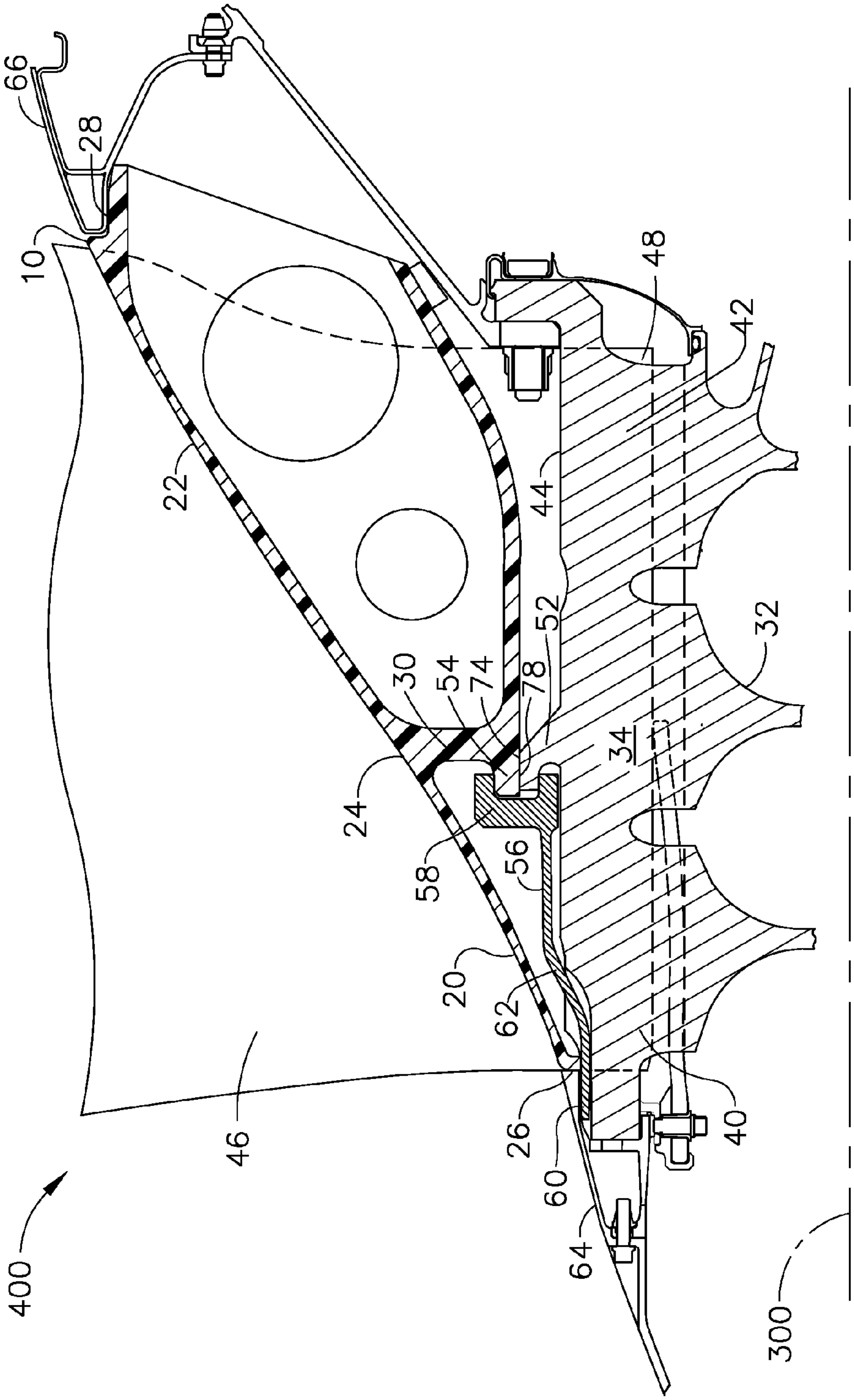
40
26
46
64
400
300

FIG. 5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44
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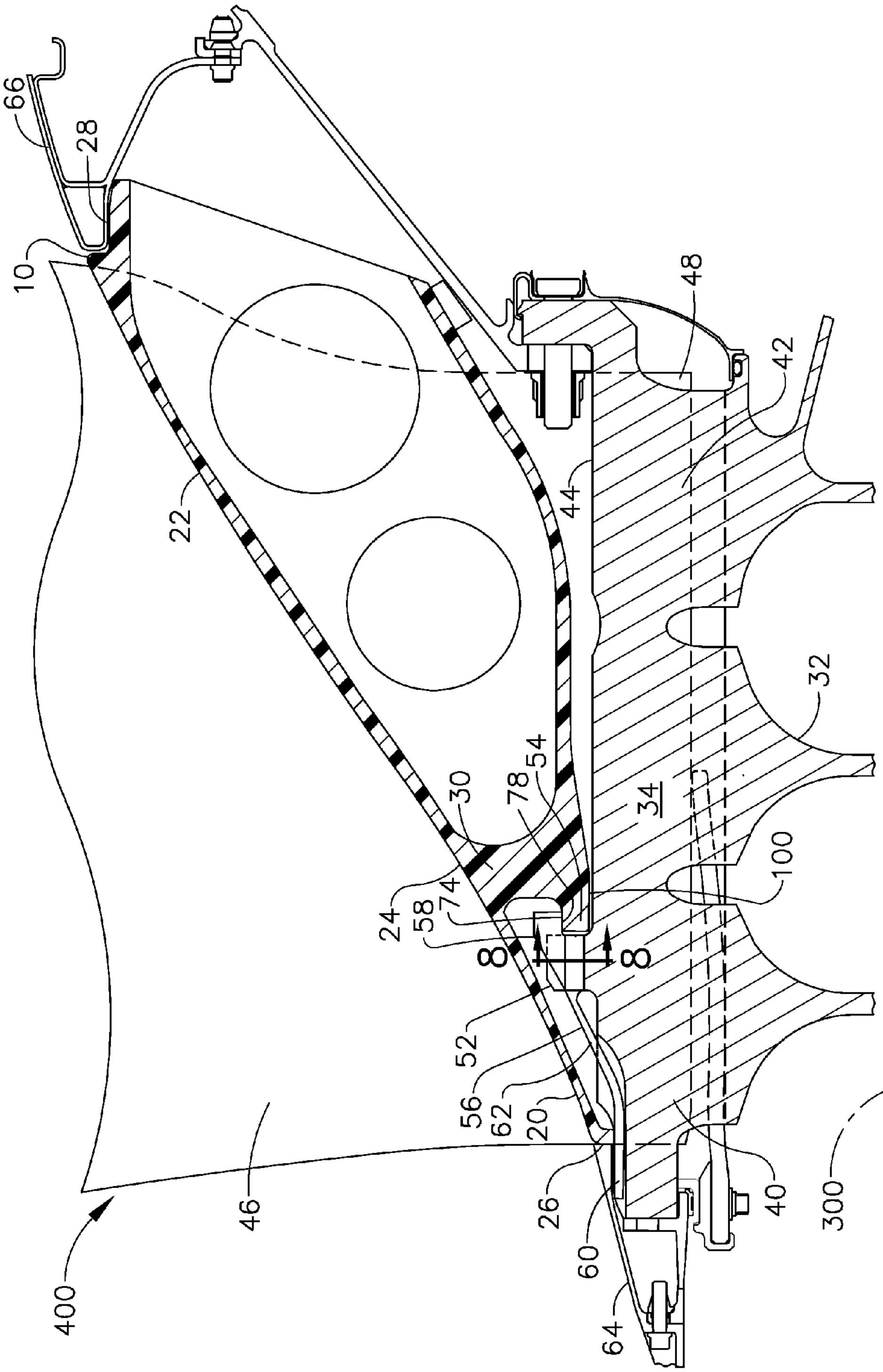
60
64
400
300

FIG. 6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54
78
30
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100
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74
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8
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52
56
62
20
26
40
300
46
400
60
64

FIG. 7

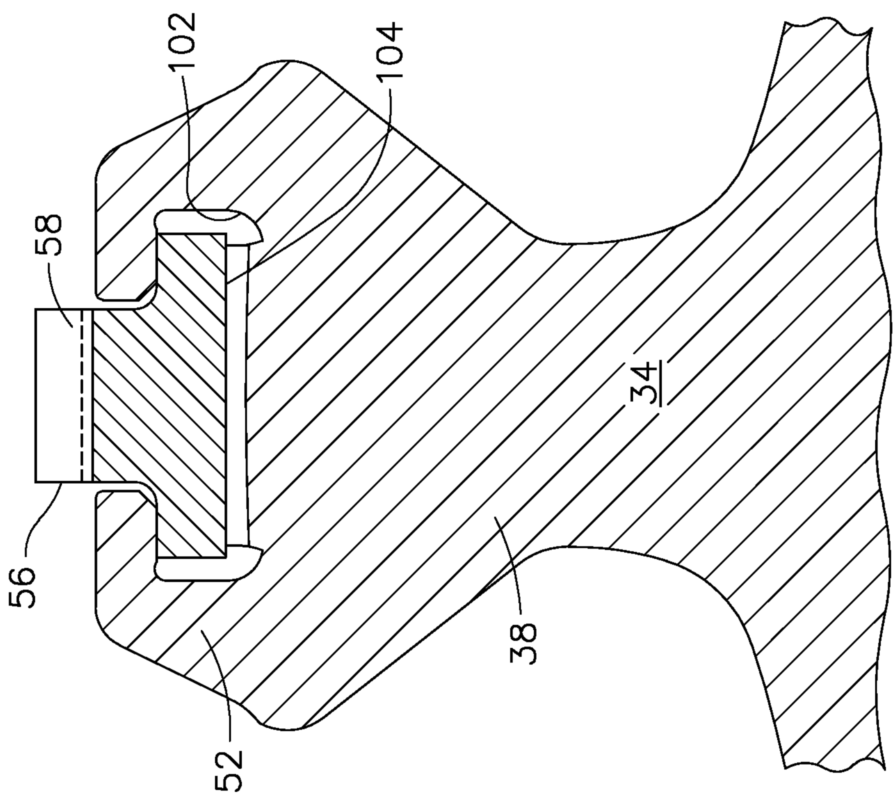
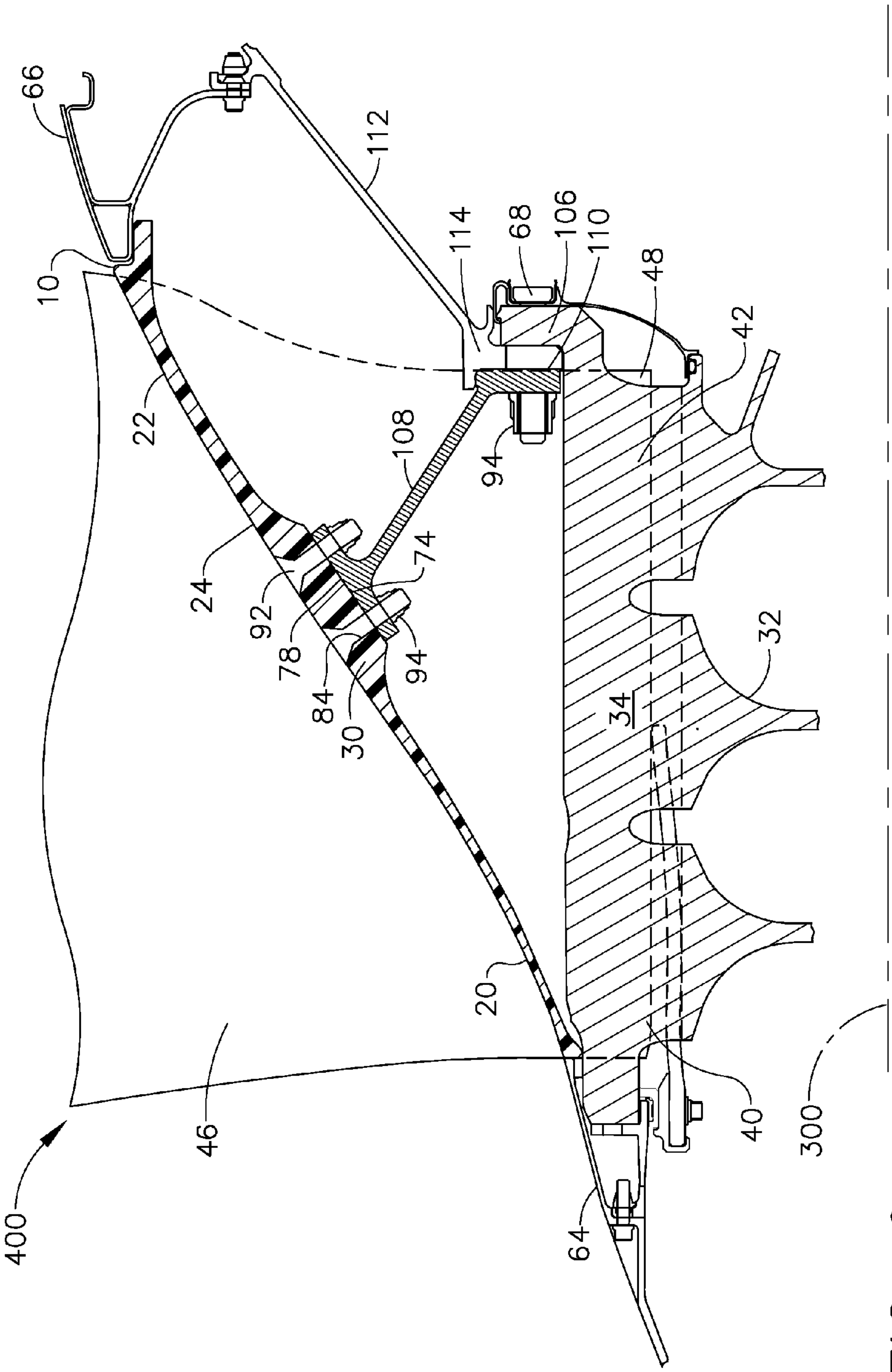


FIG. 8



66
112
114
68
106
110
48
42
10
22
108
94
24
92
74
78
94
84
30
32
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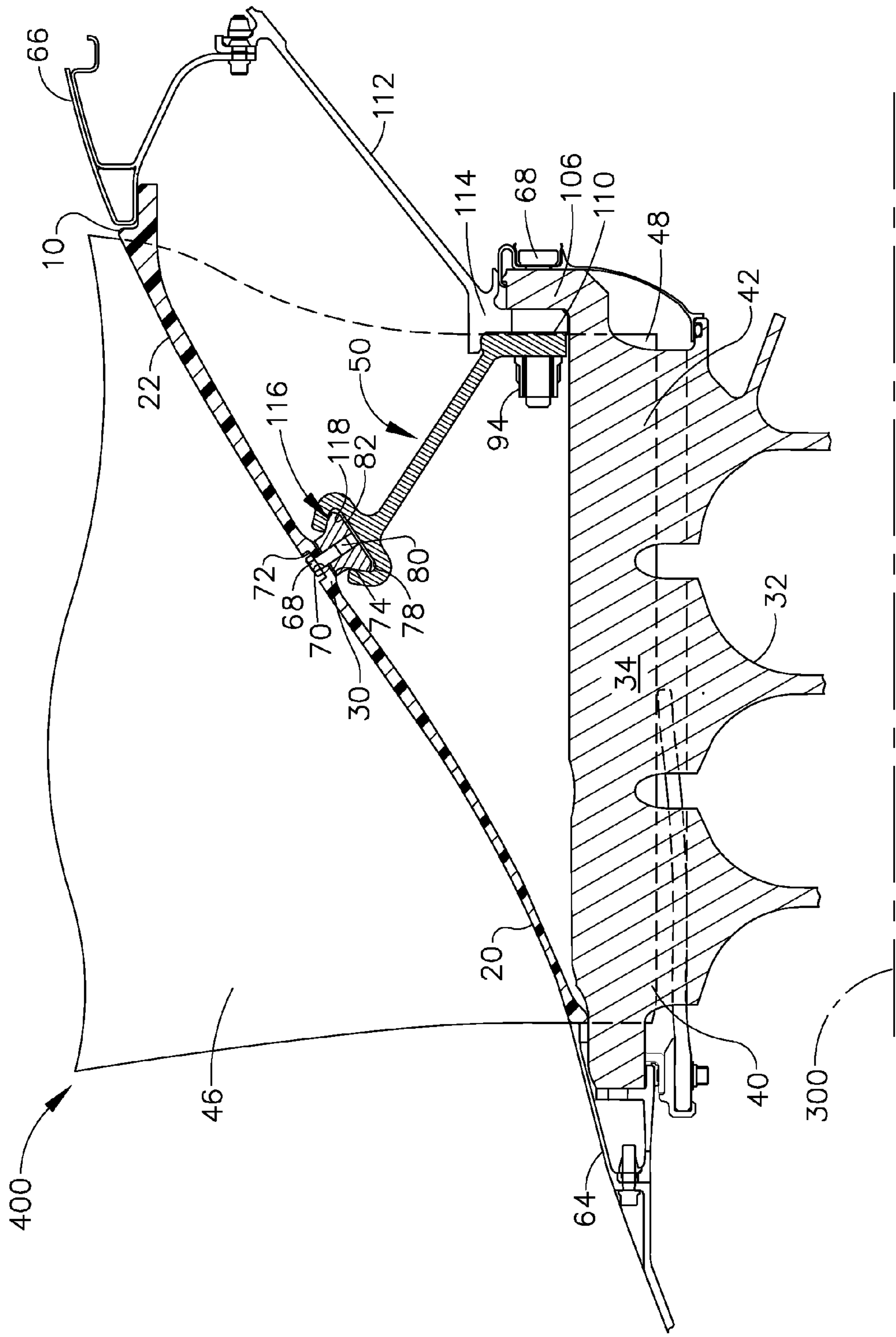
20
46
400
64
40
300

FIG. 9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116
118
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30
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32
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40
300
46
400
64

FIG. 10

NON-INTEGRAL FAN BLADE PLATFORM

BACKGROUND OF THE INVENTION

The subject matter disclosed herein relates generally to components and assemblies of gas turbine engines, and more particularly to such components and assemblies used in bypass fans.

A turbofan gas turbine engine used for propelling an aircraft includes a fan assembly having a plurality of circumferentially spaced apart fan blades extending radially outwardly from a rotor disk. Airflow is channeled between the blades and pressurized thereby for generating thrust for powering the aircraft. The fan assembly typically includes a plurality of circumferentially spaced apart fan blades each having a dovetail root disposed in a complementary, axially extending dovetail groove or slot in a perimeter or rim of a rotor disk. The dovetail grooves are defined by dovetail posts and are complementary in configuration with the blade dovetail roots for radially retaining the blades to the rotor disk. The blades are also axially retained in the rotor disk to prevent axial movement of the blades in the upstream and downstream directions. A spinner is mounted to a front end of the fan assembly to provide smooth airflow into the fan. A radially inner flowpath boundary for the airflow channeled between the blades is provided typically by integral or non-integral platforms at the blade roots.

It is often a goal to increase airflow through the fan assembly to increase thrust. This thrust increase may be accomplished by increasing the radius of the fan blade tip. However, this fan blade change impacts both a rotating airfoil and the radially adjacent fan case, adding weight at a high radial location that must be borne by the fan assembly rotor hardware during operation. Other options exist to increase airflow without increasing the fan blade tip radius. The inner flowpath boundary, often referred to as the hub, can be moved radially inwardly thus getting designated as a low radius hub. However, low radius hubs present assembly challenges between the platforms and disk as the inner flowpath boundary tends to meet the top of the disk dovetail posts at the forward end of the disk, thus limiting the space for platform interface and mounting features.

Additionally, fan assemblies, in particular fan blades, are tested against various impact and high dynamic loading events, such as bird impacts and loss of fan blade events. It is often a goal to minimize the portion of a fan blade released during such impacts and events. During these events, the platform generally makes contact with the fan blade surface, raising the opportunity for fan blade damage and potential release of fan blade portions. It would be desirable to minimize the damage and potential release of fan blade portions.

There remains a need for an improved fan platform that incorporates features to permit a low radius hub design while minimizing the damage and potential release of fan blade portions during bird impacts and loss of fan blade events.

BRIEF DESCRIPTION OF THE INVENTION

Described is a gas turbine engine fan blade platform that is located between fan blades, above a fan disk, and is a component in a rotor assembly. The rotor assembly is used in the bypass fan of a gas turbine engine. The platform has a forward portion proximal to an axis of rotation, an aft portion, and a transition portion between the forward and aft portions. The forward portion has a forward interface surface facing axially forward, the aft portion has an aft interface surface facing radially outward, and the transition portion has at least one mounting feature.

Also described is a method of assembling a gas turbine engine rotor assembly, whereby an aft support is installed on a fan disk and booster spool assembly. A fan blade is then installed into the fan disk, followed by the installation of another fan blade into the disk, just adjacent to the first. A fan platform is then installed to fill the gap between adjacent fan blades and the mounting featured is secured to the disk. The installation of fan blades and fan platforms is repeated to fill the annulus of the disk. Finally, a forward support is installed onto the fan disk.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate one or more embodiments and, together with the description, explain these embodiments. In the drawings:

FIG. **1** shows schematic illustration of a gas turbine engine having a bypass fan;

FIG. **2** is a cross-sectional view of a gas turbine engine bypass fan with an exemplary embodiment of a gas turbine engine rotor assembly;

FIG. **3** is a cross-sectional view of a gas turbine engine bypass fan with an alternative exemplary embodiment of a gas turbine engine rotor assembly;

FIG. **4** is a perspective view of the disk, fan platform, and fan blade of FIG. **3**;

FIG. **5** is a cross-sectional view of a gas turbine engine bypass fan with another alternative exemplary embodiment of a gas turbine engine rotor assembly;

FIG. **6** is a cross-sectional view of a gas turbine engine bypass fan with another alternative exemplary embodiment of a gas turbine engine rotor assembly;

FIG. **7** is a cross-sectional view of a gas turbine engine bypass fan with another alternative exemplary embodiment of a gas turbine engine rotor assembly;

FIG. **8** is cross-sectional view of the disk and attachment features for FIG. **7** through aft looking forward section **8**-**8**;

FIG. **9** is a cross-sectional view of a gas turbine engine bypass fan with another alternative exemplary embodiment of a gas turbine engine rotor assembly; and

FIG. **10** is a cross-sectional view of a gas turbine engine bypass fan with another alternative exemplary embodiment of a gas turbine engine rotor assembly;

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is provided for orientation and to illustrate selected components of a gas turbine engine **220** which includes a bypass fan **222**, a low pressure compressor **224**, a high pressure compressor **226**, a combustor **228**, a high pressure turbine **230** and a low pressure turbine **232**.

Referring to FIG. **2**, illustrated is a cross-sectional view of a gas turbine engine bypass fan **222** with an exemplary embodiment of a gas turbine engine rotor assembly **400**. The rotor assembly **400** includes a disk **32** circumscribing an axis of rotation **300** from which extends radially outward a single axially located row of circumferentially spaced apart fan blades **46**. Radially outward from the disk **32** and circumferentially positioned between adjacent fan blades **46** are fan blade platforms **10**. Each fan blade platform **10** has an axially forward facing forward interface surface **26** in axial end to end contact with a forward support **64** and a radially outward facing aft interface surface **28** in radial contact with an aft support **66**. Additionally, each fan blade platform **10** has a forward portion **20** proximal to axis of rotation **300**, an aft portion **22**, and a transition portion **24** connecting the forward portion **20** to the aft portion **22**. The transition portion **24** has a mounting feature **30**. In this exemplary embodiment, the mounting feature **30** has increased section thickness in comparison to the forward portion **20** and aft portion **22**, a clearance hole **70** running through the mounting feature **30**, and a counterbore **72**. The clearance hole **70** and counterbore **72** are concentric and their shared centerline is approximately orthogonal to the radially outer surface of the transition portion **24**. Along its maximum section thickness, mounting feature **30** further includes a radially inward mounting surface **74** approximately orthogonal to the centerline of the clearance hole **70**.

Again referring to FIG. **2**, disk **32** has a forward disk end **40**, an aft disk end **42**, a disk rim **34**, and an outer surface of the rim **44**. In this exemplary embodiment, near the forward disk end **40**, the outer surface of the rim **44** is raised radially outward to form a circumferential dovetail slot **76** that runs circumferentially across the rim **34**. Paired with each mounting feature **30** is an attachment member **50** having a radially outward mounting surface **78** mating to the radially inward mounting surface **74**, a staked threaded insert **80** and a dovetail shaped radially inboard end **82**. The attachment member **50** is inserted into the circumferential dovetail slot **76** and then a fastener **68**, a shear bolt, passes through the mounting feature **30** and is threaded into threaded insert **80**, thereby aligning and affixing the fan platform **10** to the attachment member **50** and coupling them to the disk **32** by way of the dovetail shaped radially inboard end **82** and circumferential dovetail slot **76**.

The radial assembly gap between the bottom of circumferential dovetail slot **76** and the dovetail shaped radially inboard end **82** can range between about 0.013 cm to 0.38 cm, as desired, with this exemplary embodiment being about 0.13 cm. As desired, the circumferential shape of the circumferential dovetail slot **76**, the mating dovetail shaped radially inboard end **82**, and the radial assembly gap permit the platform **10** to move circumferentially relative to the disk **32** during impact and dynamic loading events. Additionally, the interfaces of fan platform **10** with the forward support **64** and aft support **66** are fastenerless and also permit circumferential relative movement with the disk **32** during impact and dynamic loading events.

In all of the Figures which follow, like reference numerals are utilized to refer to like elements throughout the various embodiments depicted in the Figures.

Referring now FIG. **3**, illustrated is a cross-sectional view of a gas turbine engine bypass fan **222** with an alternative exemplary embodiment of a gas turbine engine rotor assembly **400**. In this exemplary embodiment, the mounting feature **30** has increased section thickness in comparison to the forward portion **20** and aft portion **22** and a pair of countersunk holes **84** running through the mounting feature **30**. The countersunk holes **84** centerlines are approximately orthogonal to the radially outer surface of the transition portion **24**. Along its maximum section thickness, mounting feature **30** further includes a radially inward mounting surface **74** approximately orthogonal to the centerlines of the countersunk holes **84**.

Again referencing FIG. **3**, near the forward disk end **40**, the outer surface of the rim **44** is raised radially outward and then axially forward to form a channel **86** that runs circumferentially across the rim **34**. Paired with each mounting feature **30** is an attachment member **50**, having a radially outward mounting surface **78** mating to the radially inward mounting surface **74**, a pair of through holes **88**, and an axially forward extending lip **90**. The attachment member **50** is inserted into the channel **86** and then countersunk fasteners **92** pass through mounting feature **30** and are threaded into nuts **94**, thereby aligning and affixing the fan platform **10** to the attachment member **50** and coupling them to the disk **32** by way of the channel **86** and the axially forward extending lip **90**.

The radial assembly gap between of the axially forward extending lip **90** and the outer surface of the rim **44** can range between about 0.013 cm to 0.38 cm, as desired, with this exemplary embodiment being about 0.13 cm. The circumferential shape of the channel **86**, the mating axially forward extending lip **90**, and the radial assembly gap permit the platform **10** to move circumferentially relative to the disk **32** during impact and dynamic loading events, as desired. Additionally, the portions of the fan platform **10** interfacing with the forward support **64** and aft support **66** are adapted to be fastenerless and also thereby permit circumferential relative movement with the disk **32** during impact and dynamic loading events.

FIG. **4** illustrates the perspective view of the alternative exemplary embodiment of the rotor assembly **400** of FIG. **3**, describing the radially outward positioning of the fan platform **10** and fan blade **46** relative to the disk **32**. Also described are features of the disk **32** including sixteen circumferentially spaced dovetail slots **36** disposed about the rim **34**, extending circumferentially between disk posts **38**, extending axially from a forward disk end **40** to an aft disk end **42**, and extending radially inward from a disk outer surface of the rim **44**. For this alternative exemplary embodiment, a complimentary set of sixteen fan blades **46** having dovetail roots **48** disposed in the dovetail slots **36** and circumferentially adjacent fan platforms **10** would be present, however, to better describe the alternative exemplary embodiment of the rotor assembly **400**, only three fan blades **46** and fan platforms **10** are illustrated. Although sixteen slots **36** and blades **46** are described, any number of slots **36**, platforms **10**, and blades **46** could be utilized in the rotor assembly **400**. Further details of the fan platform **10** described in FIG. **4** include the forward interface surface **26**, the aft interface surface **28**, the forward portion **20** being proximal to an axis of rotation **300**, the aft portion **22**, and the transition portion **24** connecting the forward portion **20** to the aft portion **22**. The radially outer surfaces of these portions form the inner flowpath boundary between fan blades **46**.

Referring now to FIG. **5**, illustrated is a cross-sectional view of a gas turbine engine bypass fan **222** with another alternative exemplary embodiment of a gas turbine engine rotor assembly **400**. In this exemplary embodiment, the mounting feature **30** has increased section thickness in comparison to the forward portion **20** and aft portion **22**, a clearance hole **70** running through the mounting feature **30**, and a counterbore **72**. The clearance hole **70** and counterbore **72** are concentric and their shared centerline is approximately orthogonal to the radially outer surface of the transition portion **24**. Along its maximum section thickness, mounting feature **30** further includes a radially inward mounting surface **74** approximately orthogonal to the centerline of the clearance hole **70**.

Again referring to FIG. **5**, near the forward disk end **40**, the outer surface of the rim **44** is raised radially outward to form a circumferential aperture **96** that runs circumferentially across the rim **34**. Paired with each mounting feature **30** is an attachment member **50**, having a radially outward mounting surface **78** mating to the radially inward mounting surface **74**, and an arch shaped cross-section having opposing interface ends **98**. The attachment member **50** is inserted into the circumferential aperture **96** and then fastener **68**, a flat-head shear bolt, passes through the mounting feature **30** and is threaded into nut **94**, thereby aligning and affixing the fan platform **10** to the attachment member **50** and coupling them to the disk **32** by way of the opposing interface ends **98** and the circumferential aperture **96**.

The radial assembly gap between the bottom of circumferential aperture **96** and opposing interface ends **98** can range between about 0.013 cm to 0.38 cm, as desired, with this exemplary embodiment being about 0.13 cm. As desired, the circumferential shape of the circumferential aperture **96**, the mating opposing interface ends **98**, and the radial assembly gap permit the platform **10** to move circumferentially relative to the disk **32** during impact and dynamic loading events. Additionally, the portions of the fan platform **10** interfacing with the forward support **64** and aft support **66** are adapted to be fastenerless and also thereby permit circumferential relative movement with the disk **32** during impact and dynamic loading events.

Moving now to FIG. **6**, illustrated is a cross-sectional view of a gas turbine engine bypass fan **222** with another alternative exemplary embodiment of a gas turbine engine rotor assembly **400**. In this exemplary embodiment, the mounting feature **30** has engagement tang **54** extending radially inward and axially forward. The most radially inward surface of mounting feature **30** further includes a radially inward mounting surface **74** approximately parallel with the axis of rotation **300**.

Again referring to FIG. **6**, near the forward disk end **40**, the outer surface of the rim **44** is raised radially outward to form a disk post hook **52** that runs circumferentially across the rim **34**. Disk post hook **52** has a radially outward surface **78** mating to the radially inward mounting surface **74**. A captured clip **56** having an engagement end **58**, a captured end **60**, and bridge portion **62**, connecting the captured end **60** to the engagement end **58**, is located radially outward of the outer surface of the rim **44** and radially inward of the forward portion **20** of the fan platform **10**. The engagement end **58** is c-shaped in cross-section and is assembled with the engagement tang **54** and disk post hook **52** thereby aligning and coupling the fan platform **10** to the disk **32**.

The radial assembly gap between the bottom of engagement end **58** and the outer surface of the rim **44** can range between about 0.013 cm to 0.38 cm, as desired, with this exemplary embodiment being about 0.13 cm. As desired, the circumferential shape of the disk post hook **52**, the mating engagement tang **54**, engagement end **58**, and the radial assembly gap permit the platform **10** to move circumferentially relative to the disk **32** during impact and dynamic loading events. Additionally, the portions of the fan platform **10** interfacing with the forward support **64** and aft support **66**, as well as the mounting feature **30**, are all adapted to be fastenerless and also thereby permit circumferential relative movement with the disk **32** during impact and dynamic loading events.

FIG. **7** illustrates a cross-sectional view of a gas turbine engine bypass fan **222** with another alternative exemplary embodiment of a gas turbine engine rotor assembly **400**. In this exemplary embodiment, the mounting feature **30** has engagement tang **54** extending radially inward and axially forward. Mounting feature **30** having further a radially inward clearance surface **100**, and radially outward mounting surface **78**, both approximately parallel with the axis of rotation **300**.

Once again referring to FIG. **7**, near the forward disk end **40**, the outer surface of the rim **44** is raised radially outward to form a disk post hook **52**. In this alternative exemplary embodiment, as shown in FIG. **8**, an aft looking forward sectional view at the disk post hook **52** taken from section **8-8** of FIG. **7**, where the disk post hook **52** has an axial t-slot **102** that projects axially along the rim **34** radially above the disk rim outer surface **44**. A captured clip **56** having an engagement end **58**, a captured end **60**, and bridge portion **62**, connecting the captured end **60** to the engagement end **58**, is located radially outward of the outer surface of the rim **44** and radially inward of the forward portion **20** of the fan platform **10**. As shown in FIG. **7** and FIG. **8** the engagement end has a radially inward mounting surface **74** and an axial t-shaped section **104** complimentary to the axial t-slot **102** of disk hook **52**. The engagement end **58** is assembled with the engagement tang **54** and disk post hook **52** thereby aligning and coupling the fan platform **10** to the disk **32**.

The radial assembly gap between the radially inward clearance surface and the outer surface of the rim **44** can range between about 0.013 cm to 0.38 cm, as desired, with this exemplary embodiment being about 0.13 cm. As desired, the circumferential shape of the engagement tang **54** and mating engagement end **58**, along with the radial assembly gap, permit the platform **10** to move circumferentially relative to the disk **32** during impact and dynamic loading events. Additionally, the portions of the fan platform **10** interfacing with the forward support **64** and aft support **66**, as well as the mounting feature **30**, are all adapted to be fastenerless and also thereby permit circumferential relative movement with the disk **32** during impact and dynamic loading events.

In the alternative exemplary embodiments of a gas turbine engine rotor assembly **400** shown in FIG. **6** and FIG. **7**, the captured end **60** projects axially forward and radially below forward interface surface **26**, terminating just aft of the axially forward-most edge of the disk forward end **40**. The captured end **60** rests on the disk outer surface **44** and is captured radially by the forward support **64** and forward portion **20**. Alternative methods of retaining the captured end **60** include, for example, extending the captured end **60** forward and radially inward, thereby nesting the captured end **60** on the axially forward-most edge of the disk forward end **40**. Such an extended captured end **60** could again be retained radially by the forward support **64** and forward portion **20** or alternatively fastened to the disk forward end **40**

FIG. **9** illustrates a cross-sectional view of a gas turbine engine bypass fan **222** with another alternative exemplary embodiment of a gas turbine engine rotor assembly **400**. In this exemplary embodiment, the mounting feature **30** has increased section thickness in comparison to the forward portion **20** and aft portion **22** and a pair of countersunk holes **84** running through the mounting feature **30**. The countersunk holes **84** centerlines are approximately orthogonal to the radially outer surface of the transition portion **24**. Along its maximum section thickness, mounting feature **30** further includes a radially inward mounting surface **74** approximately orthogonal to the centerlines of the countersunk holes **84**.

Again referring to FIG. **9**, disk **32** has a forward disk end **40**, and an aft disk end **42**. At the aft disk end **42** each disk post **38** has a vertical mount **106**. Paired with each mounting feature **30** is an attachment member **50**, having a radially outward mounting surface **78** complimenting the radially inward mounting surface **74**, a truss arm **108**, and an aft mounting surface **110**. A booster spool **112**, circumscribing axis of rotation **300**, is located radially outward of disk **32** and generally aft of both the aft disk end **42** and attachment members **50**, and has a vertical bolting flange **114**. The aft mounting surface **110** of attachment member **50** is matched up with a vertical mount **106**, and vertical bolting flange **114**. Then fastener **68** is inserted through the vertical mount **106**, vertical bolting flange **114**, and attachment member **50**, and is threaded into a nut **94**. Continuing the assembly, platform **10** is presented to attachment member **50**, and countersunk fasteners **92** are passed through mounting feature **30** and attachment member **50** and threaded into nuts **94**, thereby aligning and affixing the fan platform **10** to the attachment member **50** and coupling them to the disk **32** by way of the aft mounting surface **110** and vertical mount **106**.

The combination of the truss arm **108**, aft portion **22**, aft support **66**, and booster spool **112**, when viewed in section, roughly form a four-sided box structure that efficiently carries the majority of the mass of the platform **10** during operation of the rotor assembly **400**. This efficient box structure permits the interface of the fan platform **10** with the forward support **64** to be fastenerless and eliminates the need for additional disk complexity on the disk rim outer surface **44**, ultimately reducing platform weight, assembly complexity, and assembly time while permitting a low radius hub design.

Referring now to FIG. **10**, illustrated is a cross-sectional view of a gas turbine engine bypass fan **222** with yet another alternative exemplary embodiment of a gas turbine engine rotor assembly **400**. In this exemplary embodiment, the mounting feature **30** again has increased section thickness in comparison to the forward portion **20** and aft portion **22**, a clearance hole **70** running through the mounting feature **30**, and a counterbore **72**. The clearance hole **70** and counterbore **72** are concentric and their shared centerline is approximately orthogonal to the radially outer surface of the transition portion **24**. Along its maximum section thickness, mounting feature **30** further includes a radially inward mounting surface **74** approximately orthogonal to the centerline of the clearance hole **70**. In this exemplary embodiment, matched with each mounting feature **30** and attachment member **50** is a separable dovetail insert **116**. The insert **116** has a mounting face **118** mating to the radially inward mounting surface **74**, a staked threaded insert **80**, and a dovetail shaped radially inboard end **82**. The radially outward mounting surface **78** of attachment member **50** is shaped as a circumferential dovetail slot complimentary to the dovetail shaped radially inboard end **82** of insert **116**. The insert **116** is placed into the attachment member **50**, mating the dovetail shape features, and then a fastener **68**, a shear bolt, passes through the mounting feature **30** and is threaded into threaded insert **80**, thereby aligning and affixing the fan platform **10** to the insert **116** and coupling them to the attachment member **50** by way of the dovetail shaped radially inboard end **82** and radially outward mounting surface **78** of attachment member **50**.

The same efficient box structure as in described in FIG. **9** is present in this exemplary embodiment, eliminating the need for additional disk complexity on the disk rim outer surface **44**, reducing platform weight, assembly complexity and time and once again permitting a low radius hub design. The radial assembly gap between the dovetail shaped radially inboard end **82** and radially outward mounting surface **78** of attachment member **50** can range between about 0.013 cm to 0.38 cm, as desired, with this exemplary embodiment being about 0.13 cm. Additionally, as desired, the circumferential shape of dovetail shaped radially inboard end **82** and radially outward mounting surface **78**, along with the radial assembly gap, permit the platform **10** to move circumferentially relative to the disk **32** during impact and dynamic loading events. In this exemplary embodiment, the interfaces of the fan platform **10** with the forward support **64** and aft support **66** are both fastenerless also permit circumferential relative movement with the disk **32** during impact and dynamic loading events.

Descriptions of the assembly for securing the mounting feature **30** to the fan disk **32** using attachment members **50**, captured clips **56**, or alternatively attachment members **50** and separable inserts **116**, are included in the details of each exemplary embodiment of rotor assembly **400** above. To assemble the larger rotor assembly **400**, first an assembly of the fan disk **32** and booster spool **112** is provided. Then an aft support **66** is presented and fastened to the booster spool **112**. Next a fan blade **46** is inserted into a dovetail slot **36** of the fan disk **32**, followed by inserting a second fan blade **46** into a neighboring disk slot **36**. Then a fan platform **10** is installed circumferentially between the fan blades **46** and radially above the disk **32**, positioned axially by the aft support **66**, and generally aligned with the disk **32**. The mounting feature **30** of the fan platform **10** is then secured to the disk **32**. This sequence, starting with the introduction of a fan blade **46**, is then repeated for subsequent dovetail slots **36** until the full annulus of the fan disk **32** is populated with fan blades **46**, mounting features **30** and associated fan platforms **10**. Finally, a forward support **64** is secured on the forward disk end **49** of the fan disk **32**.

Suitable manufacturing methods and materials for the individual components of the exemplary embodiments of the rotor assembly **400** are generally known in the aerospace industry and include, for example, general aerospace manufacturing methods such as machining of steel, aluminum, or titanium plate as well as autoclave processing and compression molding of polymer composites. Suitable assembly specifications such as bolt torques, lubrication, and the like, include those generally known in the aerospace industry.

The foregoing description of the embodiments of the invention is provided for illustrative purposes only and is not intended to limit the scope of the invention as defined in the appended claims. Other modifications of the invention shall be apparent to those skilled in the art from the teachings herein, and it is, therefore, desired to be secured in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A gas turbine engine rotor assembly comprising:

a disk having a disk rim, a plurality of dovetail slots, and a plurality of disk posts, each disk post having at least one disk post hook, wherein the disk posts are circumferentially disposed around the rim and the dovetail slots are disposed circumferentially between disk posts;

a plurality of fan blades having dovetail roots disposed in the dovetail slots,

a plurality of fan platforms, each of the fan platforms having a forward portion having a forward interface surface facing axially forward, an aft portion having an aft interface surface facing radially outward, and a transition portion having at least one mounting feature, the mounting feature having at least one engagement tang, wherein the transition portion is connectively disposed between the forward portion and aft portion, wherein the fan platforms are circumferentially disposed between the fan blades; and

a plurality of captured clips, each captured clip having an engagement end, wherein each of the captured clips are circumferentially disposed between the fan blades and radially disposed between the disk and the fan platform, whereby the engagement end couples the engagement tangs to the disk post hooks.

2. A gas turbine engine rotor assembly in accordance with claim **1**, whereby the captured clips have shapes which permit relative circumferential motion between the fan platform and the disk posts.

3. A gas turbine engine rotor assembly in accordance with claim 1, wherein the forward portion and aft portion are adapted to be fastenerless.

4. A gas turbine engine comprising a bypass fan, said bypass fan including a gas turbine engine rotor assembly comprising:

a disk having a disk rim, a plurality of dovetail slots, and a plurality of disk posts, wherein the disk posts are circumferentially disposed around the rim and the dovetail slots are disposed circumferentially between disk posts;

a plurality of fan blades having dovetail roots disposed in the dovetail slots;

a plurality of fan platforms, each of the fan platforms having a forward portion having a forward interface surface facing axially forward, an aft portion having an aft interface surface facing radially outward, and a transition portion having at least one mounting feature, wherein the transition portion is connectively disposed between the forward portion and aft portion, wherein the fan platforms are circumferentially disposed between the fan blades; and

a plurality of attachment members, wherein each of the attachment members are circumferentially disposed between the fan blades and connectively disposed between the platform transition portions and disk posts, the attachment members comprising a plurality of captured clips, each captured clip having an engagement end, wherein each of the captured clips are circumferentially disposed between the fan blades and radially disposed between the disk and the fan platform, whereby the engagement end couples the engagement tangs to the disk post hooks.

5. A gas turbine engine in accordance with claim 4, wherein the mounting features and the attachment members are adapted to receive at least one fastener.

6. A gas turbine engine in accordance with claim 4, wherein the attachment members have shapes which permit relative circumferential motion between the fan platform and the disk posts.

7. A gas turbine engine in accordance with claim 4, wherein the forward portions and aft portions are adapted to be fastenerless.

8. A gas turbine engine comprising a bypass fan, said bypass fan including a gas turbine engine rotor assembly comprising:

a disk having a disk rim, a plurality of dovetail slots, and a plurality of disk posts, each disk post having at least one disk post hook, wherein the disk posts are circumferentially disposed around the rim and the dovetail slots are disposed circumferentially between disk posts;

a plurality of fan blades having dovetail roots disposed in the dovetail slots,

a plurality of fan platforms, each of the fan platforms having a forward portion having a forward interface surface facing axially forward, an aft portion having an aft interface surface facing radially outward, and a transition portion having at least one mounting feature, the mounting feature having at least one engagement tang, wherein the transition portion is connectively disposed between the forward portion and aft portion, wherein the fan platforms are circumferentially disposed between the fan blades; and

a plurality of captured clips, each captured clip having an engagement end, wherein each of the captured clips are circumferentially disposed between the fan blades and radially disposed between the disk and the fan platform, whereby the engagement end couples the engagement tangs to the disk post hooks.

9. A gas turbine engine in accordance with claim 8, whereby the captured clips have shapes which permit relative circumferential motion between the fan platform and the disk posts.

10. A gas turbine engine in accordance with claim 8, wherein the forward portion and aft portion are adapted to be fastenerless.

11. A method of assembling a gas turbine engine rotor assembly, the method comprising the steps:

a) providing a fan disk and booster spool assembly;

b) installing an aft support on the booster spool;

c) installing a fan blade into the fan disk;

d) installing a fan blade into the fan disk adjacent to the fan blade in step c);

e) installing a fan platform including a mounting feature between the adjacent fan blades;

f) securing the mounting feature to the fan disk using a captured clip;

g) repeating steps c) through f) until the fan disk is populated with fan blades and secured mounting features; and

h) installing a forward support onto the fan disk.

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